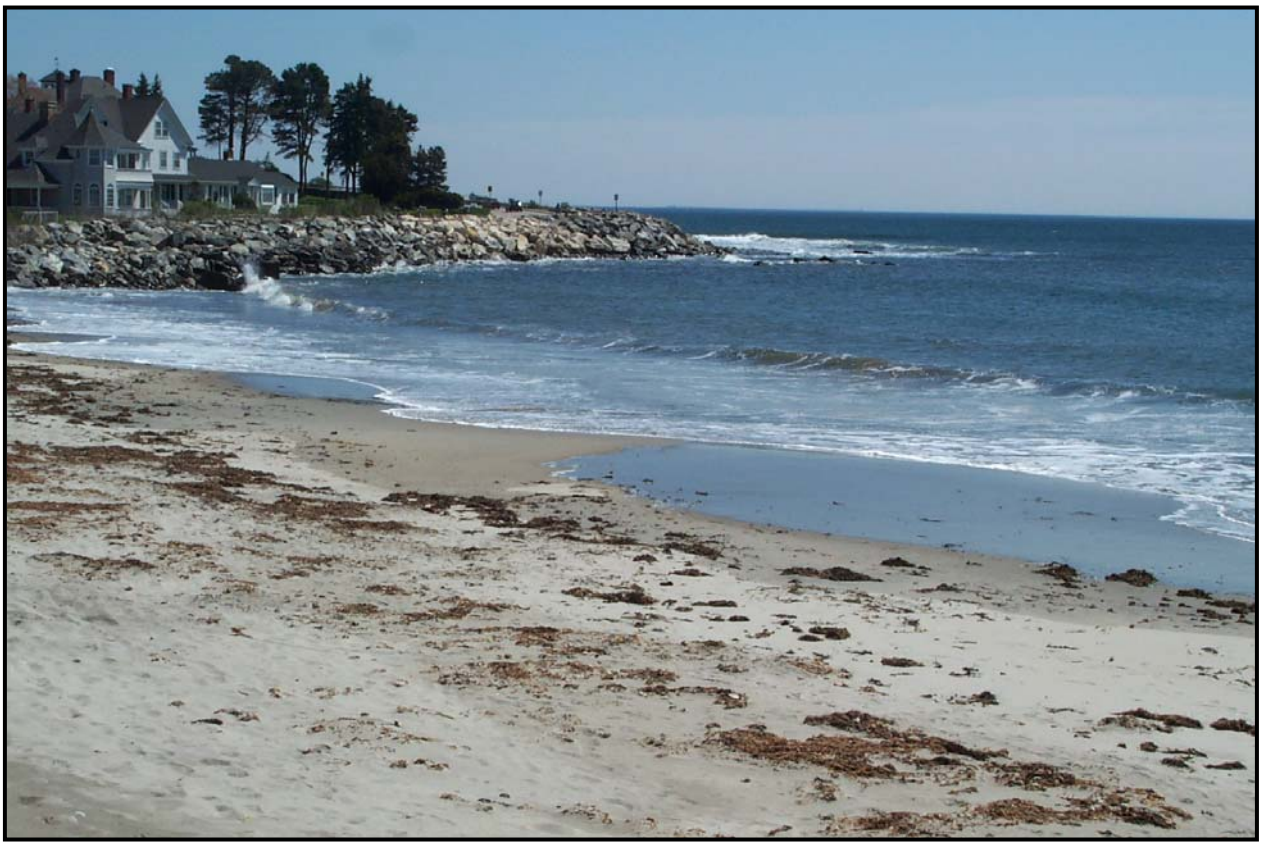
State Beach, North Hampton

BEACH WATER QUALITY REPORT
SUMMER 2006



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NEW HAMPSHIRE DEPARTMENT OF Environmental Services

BACKGROUND

The New Hampshire Department of Environmental Services (DES) has operated a Public Beach Inspection Program, or Beach Program, for over 20 years. An established coastal beach monitoring program began in 1989 and the program continues to provide monitoring on a weekly basis. DES recognizes the health threat at public beaches. As a result, increased beach monitoring and bacteria source tracking have been implemented to further protect public health.

Coastal beaches are monitored for the presence of the fecal bacteria Enterococci. These fecal bacteria are present in the intestines of warm-blooded animals including humans. Fecal bacteria, when present in high concentrations and ingested, can commonly cause gastrointestinal illnesses such as nausea, vomiting and diarrhea. They are also known as indicator organisms, meaning their presence in water may indicate the presence of other potentially pathogenic organisms.

In October of 2000, the United States Environmental Protection Agency (EPA) signed into law the Beaches Environmental Assessment and Coastal Health (BEACH) Act. The BEACH Act is an amendment to the Clean Water Act, which authorizes the EPA to award grants to eligible states. The purpose of the BEACH Act is to reduce the risk of disease to users of the nation's recreational waters. BEACH Act grants provide support for development and implementation of monitoring and notification programs that help protect the public from exposure to pathogenic microorganisms in coastal recreation waters.

DES received grant funding in 2002 to develop and implement a beach monitoring and notification program consistent with EPA's performance criteria requirements published in the *National Beach Guidance and Required Performance Criteria for Grants* document (www.epa.gov/waterscience/beaches/grants). DES has successfully met all requirements and continues to expand the monitoring and notification program. In 2002, only nine coastal beaches were monitored, while in 2003 and 2004, 15 and 16 beaches respectively, were monitored on a routine basis. Fifteen beaches were sampled again in 2005 and 2006. In 2004, volunteers sampled Star Island beach, but circumstances did not allow for this cooperative effort in 2005 and 2006.

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Beach Description

State Beach is owned and maintained by the New Hampshire Division of Parks and Recreation, State Parks Bureau. The beach is composed of a sandy substrate with rocky portions at low tide. The total beach length is 1,260 feet. State Beach is bordered to the South by Plaice Cove. The beach is frequently used by residents and vacationers for various recreational activities. There are three access points to the beach area from the parking lot off Route 1A (Figure 1). Parking is available for a fee (meters). Lifeguards are present and sanitary facilities are available during the summer.

Figure 1. State Beach Access Points

Gulls, often observed in flocks are the most frequently documented waterfowl at the beach. Dogs were observed on two separate occasions at State Beach even though dogs are restricted from beach access per the New Hampshire State Parks Division.

Below is a brief description of the sampling stations at North Hampton State Beach (Figure 2).

Table 1. Station Descriptions

Description	Latitude	Longitude
Left sample station: located straight in front of the northern entrance to the beach (off a concrete step).	42˚ 57' 21.612"	-70˚ 46' 50.6255"
Center sample station: located straight in front of the center entrance to the beach.	42˚ 57' 19.2096"	-70˚ 46' 52.7805"
Right sample station: located straight in front of the southern entrance to the beach.	42˚ 57' 16.9279"	-70˚ 46' 52.3503"
Little River sample station: located on the upstream side of Route 1A in the center of the river before it flows through the culvert.	42˚ 57' 27"	-70˚ 46' 45"

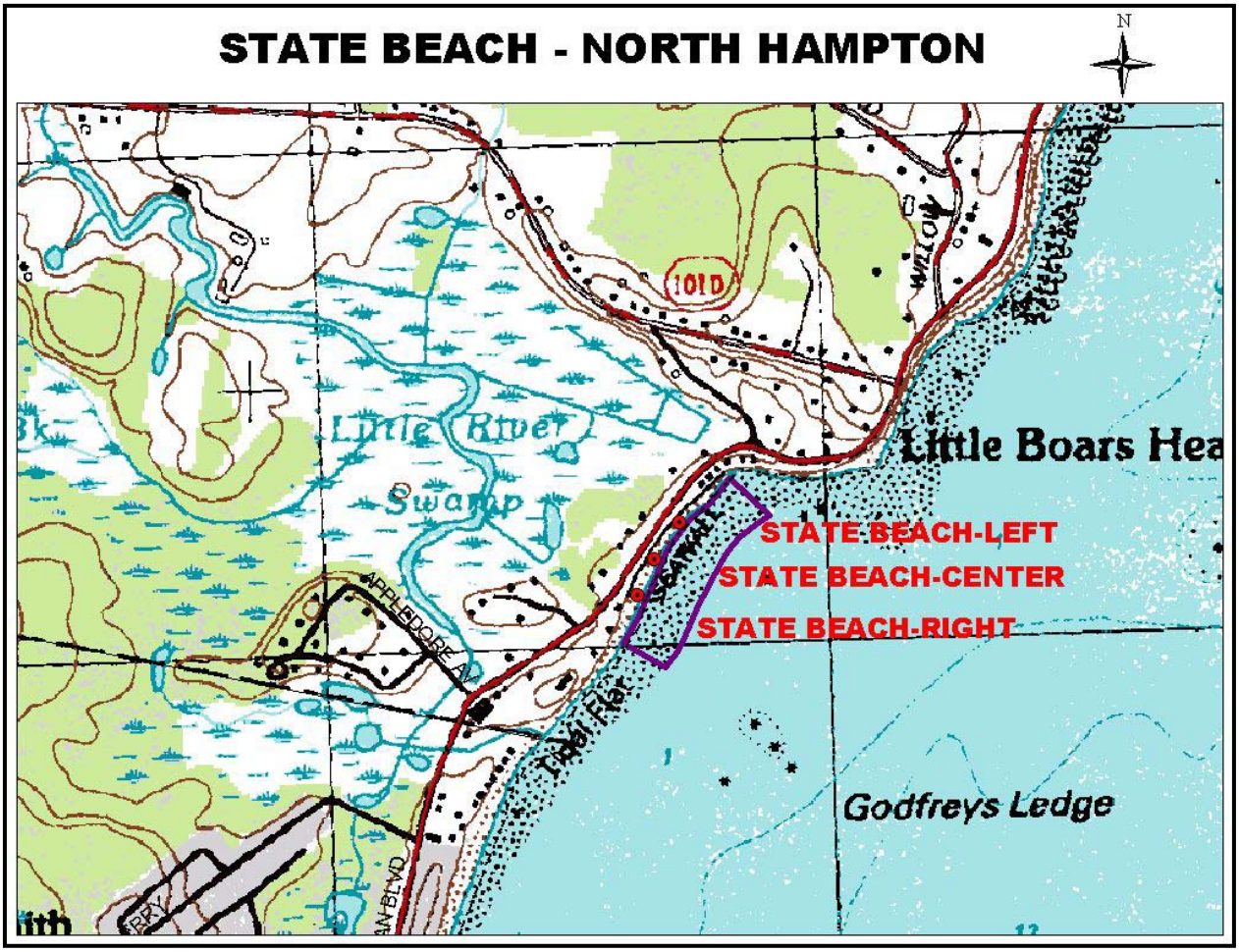

Figure 2. Map of State Beach

Tier Status and Sampling Frequency

The Beach Program developed a risk-based beach evaluation process and tiered monitoring approach and implemented this approach during the 2003 beach season. Beach evaluations are conducted annually to determine potential health threats to the public. Evaluations are based on several criteria in three main categories: beach history, microbial pathogen sources, and beach use. The evaluations for the 2006 season included a new criterion to assess beaches. Beaches are now assessed as impaired for bacteria. Impairments are based the most recent version of the Consolidated Assessment and Listing Methodology (CALM) submitted to EPA by DES every two years. The CALM assesses beach units as impaired based on historical exceedances of both the single sample and geometric mean bacteria standards.

Based on these criteria, beaches were assigned a Tier I-Impaired, Tier I or Tier II status in 2006. Tier I-Impaired beaches are high priority and have an increased potential to affect public health, Tier I are medium priority, while Tier II are low priority beaches that have less potential to affect public health. Beach sample frequency is based on the Tier statuses; Tier I-Impaired beaches were sampled twice per week, Tier I beaches were sampled once per week, and Tier II beaches were samples once every other week in 2006.

State Beach is a Tier I-Impaired beach. It was categorized as a Tier I-Impaired beach based on the Beach Program's Risk-Based Evaluation ranking system. This ranking indicates that there is frequent beach use as compared to other coastal beaches and there are potential pollution sources present that may negatively impact public health. The State Beach ranking has changed since the ranking system was implemented in 2002. State Beach is sampled twice per week during the sampling season.

Current Year Water Quality

Beaches are monitored to ensure compliance with State Water Quality Standards. Marine waters are analyzed for the presence of the fecal bacteria Enterococci. Enterococci are known as indicator organisms, meaning their presence may indicate the presence of other pathogenic organisms. The state standard for Enterococci at public beaches is 104 counts/100 mL in one sample, or a geometric mean of 35 counts/100 mL in three samples collected over 60 days. Standard exceedances require the issuance and posting of a beach advisory. Beach advisories remain in effect until subsequent beach sampling indicates safe water quality conditions.

The number of samples collected at each beach is a function of beach length. Beaches less than 100 feet in length are sampled at left and right locations 1/3 of the distance from either end of the beach. Beaches greater than 100 feet in length are bracketed into thirds and sampled at left, center and right locations. Routine sample collection may be enhanced by sampling known or suspected pollution sources to the beach area. Storm event sampling may be conducted at beaches where wet-weather events are expected to affect beach water quality.

The 2006 season's weather can best be described as unpredictable. The sampling season began May 30. During the month of May, New Hampshire experienced flood conditions typical of a 100-year flood, while the months of June and July were wetter and warmer than normal, and August was unseasonably cool and dry. May experienced over 17 inches of rain setting a record high for the month, and over eight inches of rain fell during June (as recorded at Pease International Tradeport, Portsmouth, N.H.). Precipitation was recorded on 34 days of the 95 day sampling season. Twenty-two beach days (beach hours 9:00a.m. to 5:00p.m.) were directly affected by precipitation. There were a total of 26 routine inspections performed and 124 samples collected in 2006.

Table 2 and Figure 3 depict the Enterococci data from each sampling event in 2006. Overall, the summer 2006 Enterococci levels were moderate and within the state's standards for public beaches. Enterococci levels were elevated on June 8 following over 2.5" of rainfall; however, no beach advisory was issued because the official beach season had not begun. Little River, a known pollution source, likely washed bacteria from the watershed into the beach area. State Beach was issued two advisories during the 2006 sampling season. An advisory was posted on July 13 due to elevated Enterococci levels at all three sample stations. Another storm totaling close to 3.0" of rainfall preceded the elevated levels. Extremely high Enterococci levels were recorded from Little River on the same day (Table 3 and Figure 4) likely contributing to the elevated beach Enterococci levels. The second advisory was issued on August 24 following elevated Enterococci levels at the left beach station. An abundance of seaweed on the left station

was a likely source of bacteria to the beach as seaweed can harbor bacteria and cause a spike in bacteria concentrations during sampling events.

Table 2. State Beach Enterococci Data 2006

Sample Date	Station Name	Enterococci Results (counts per 100 mL)
5/31/2006	Left	40
	Center	10
	Right	10
6/6/2006	Left	10
	Center	10
	Right	10
6/8/2006	Left	90
	Center	70
	Right	210
6/12/2006	Left	40
	Center	80
	Right	60
6/15/2006	Left	30
	Center	10
	Right	10
6/21/2006	Left	10
	Center	10
	Right	10
6/22/2006	Left	40
	Center	10
	Right	10
6/27/2006	Left	20
	Center	60
	Right	10
6/29/2006	Left	70
	Center	10
	Right	10
7/5/2006	Left	10
	Center	10
	Right	10
7/10/2006	Left	10
	Center	20
	Right	10
7/13/2006	Left	330
	Center	300
	Right	280
7/17/2006	Left	30
	Center	40
	Right	30

7/18/2006	Left	10
	Center	20
	Right	10
7/19/2006	Left	10
	Center	20
	Right	10
7/24/2006	Left	10
	Center	10
	Right	30
7/25/2006	Left	10
	Center	10
	Right	5
8/2/2006	Left	10
	Center	10
	Right	10
8/3/2006	Left	10
	Center	20
	Right	10
8/8/2006	Left	10
	Center	10
	Right	70
8/9/2006	Left	10
	Center	10
	Right	10
8/14/2006	Left	10
	Center	10
	Right	10
8/15/2006	Left	10
	Center	10
	Right	10
8/23/2006	Left	10
	Center	5
	Right	10
8/24/2006	Left	740
	Center	10
	Right	10
8/25/2006	Left	10
	Center	10
	Right	5
8/29/2006	Left	20
	Center	10
	Right	30
8/30/2006	Left	10
	Center	10
	Right	10

Figure 3 depicts the Enterococci data in relation to the state standard for coastal beaches.

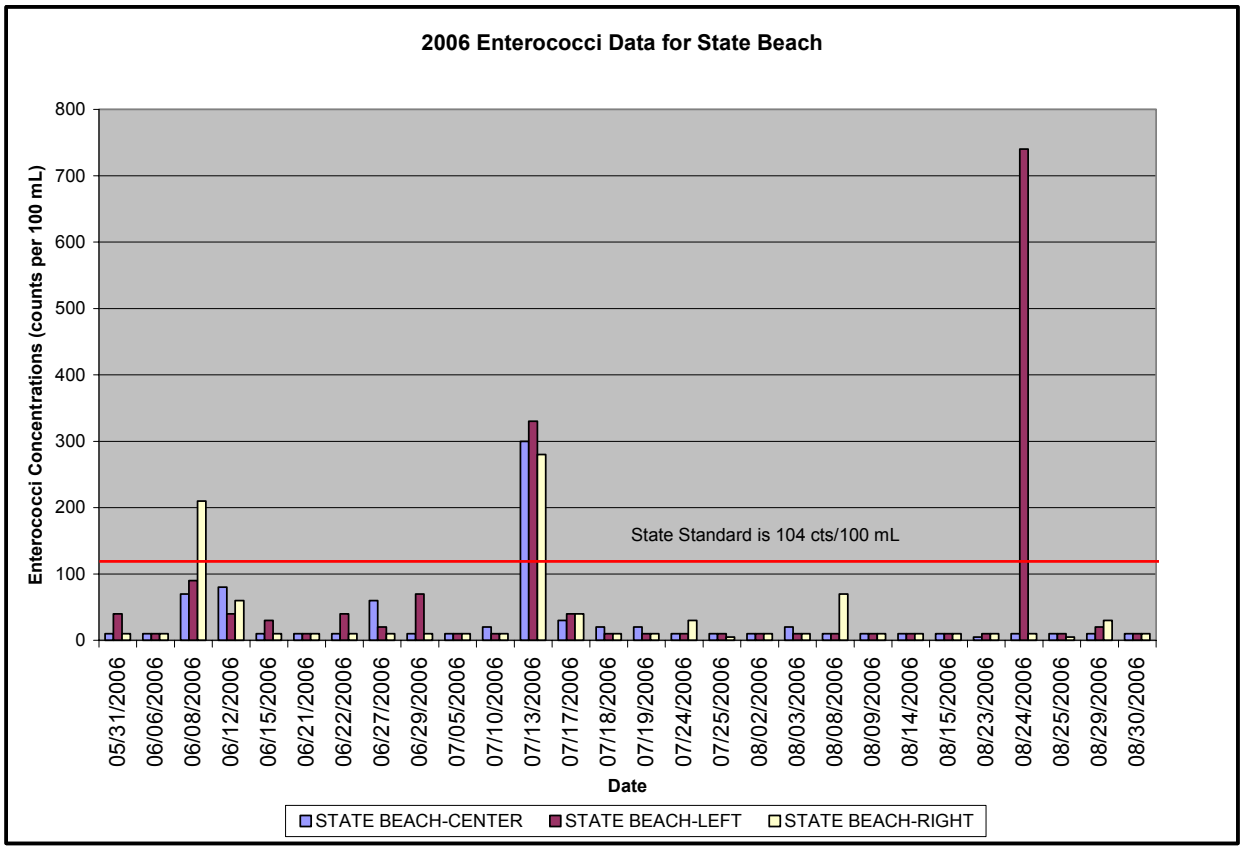

Figure 3. State Beach Enterococci Data 2006

Table 3 includes Enterococci data from Little River. Enterococci levels in Little River fluctuated throughout the summer months (Figure 4). Samples were collected during low tide conditions when flow from the salt marsh was directed towards the beach area. Enterococci levels were consistently elevated in July and August. There were several rain events of around 0.5 inches or greater during that period. Figure 5 depicts summer precipitation and Little River Enterococci levels. Elevated Enterococci levels were typically preceded by rain events greater than 0.5 inches.

Table 3. Little River Enterococci Data 2006

Sample Date	Enterococci Results (counts per 100 mL)
5/31/2006	50
6/12/2006	10
6/15/2006	150
6/21/2006	50
6/27/2006	90
6/29/2006	80
7/5/2006	120
7/13/2006	1270
7/17/2006	150
7/18/2006	70
7/19/2006	90
8/2/2006	100
8/3/2006	440
8/14/2006	40
8/15/2006	370
8/25/2006	110
8/29/2006	400
8/30/2006	260

Figure 4 depicts the 2006 Enterococci data from Little River.

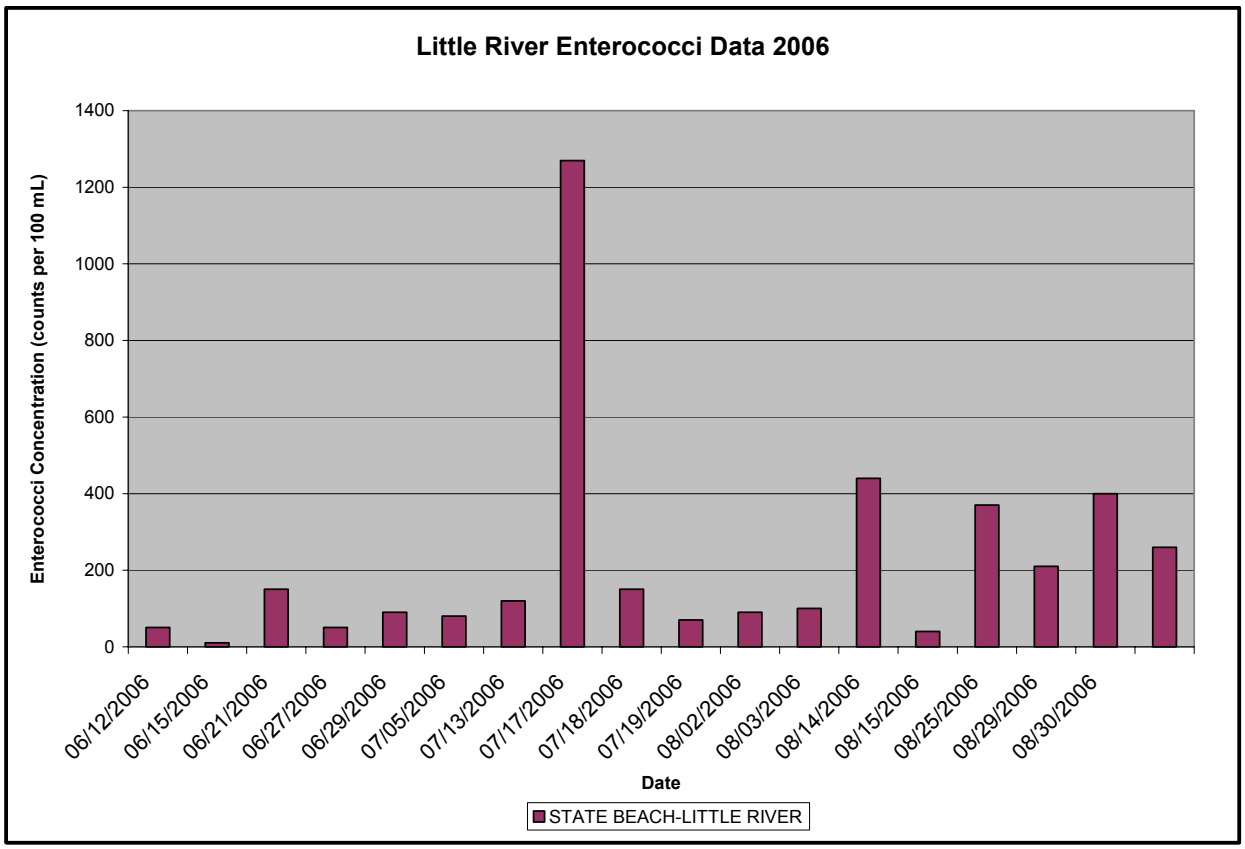

Figure 4. Little River Enterococci Data 2006

Figure 5 depicts the relationship between Enterococci levels at Little River and precipitation

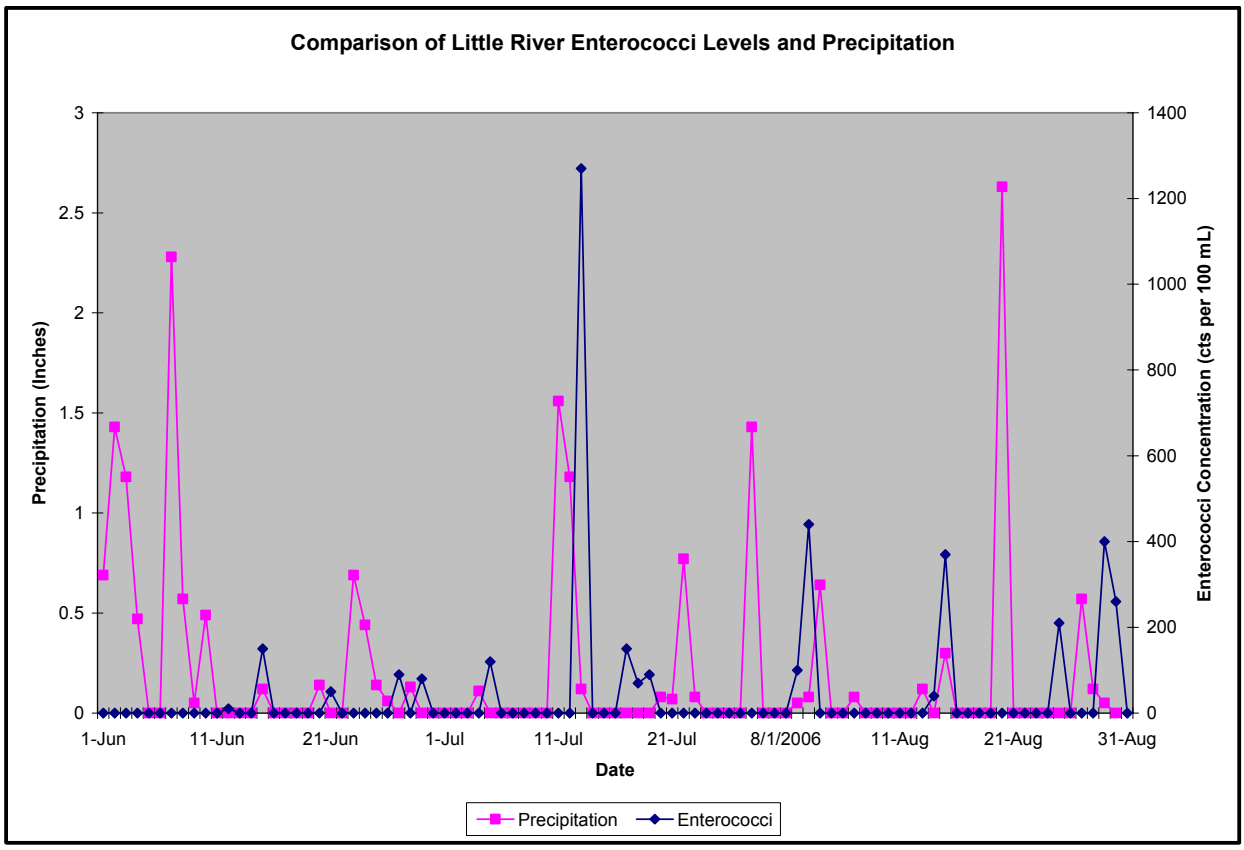

Figure 5. Comparison of Enterococci Levels and Precipitation at Little River

Areas of Concern

Little River is an area of concern at State Beach. The river has been identified as a pollution source to coastal waters contributing to elevated bacteria levels. Enterococci levels in Little River are negatively impacted after rainfall. Precipitation and associated runoff washes bacteria from the land into Little River resulting in the discharge of bacteria laden waters to State Beach. A microbial source tracking study conducted in 2004 identified wildlife, domestic animals and humans as primary sources of bacteria. Human sources are most likely the result of failed septic systems and should be addressed by the Town of North Hampton. The 2006 data indicate that Little River Enterococci levels elevate after rainfall events of 0.5 inches or greater. The left beach station should be monitored regularly after precipitation events greater than 0.5 inches. A pre-emptive rainfall advisory may be warranted for State Beach. The potential for pre-emptive advisories will be determined after additional precipitation monitoring and data modeling.

Waterfowl were frequently observed during the season. Waterfowl can defecate up to 28 times per day, contributing to beach fecal pollution. The tides can cause the fecal material and associated bacteria to become suspended in the water, contributing to a public health risk. The town should continue to discourage visitors from feeding the waterfowl to decrease beach bacteria levels.

Thoughts for the Future

- The beach inspector noticed people playing in the tunnel around Little River. Signage should be displayed to warn the public of potential dangers in and around the tunnel and the Town of North Hampton should limit access to the area.

- The State Parks division, local businesses, or school groups should participate in DES's Adopt-a-Beach Program. The program would consist of beach clean-ups and water quality monitoring. DES would conduct training sessions and participate in education and outreach activities for the community. If you are interested, please contact Alicia Carlson at (603) 271-0698 or acarlson@des.state.nh.us.

- A pre-emptive rainfall advisory may be necessary at State Beach. An analysis of historical bacteria data and rainfall may indicate a rainfall level above which beach Enterococci levels are consistently elevated. Rainfall amounts exceeding this level will result in automatic beach advisories. A pre-emptive advisory plan will need to be devised and discussed by the beach manager and the Beach Coordinator.

Appendix A

Special Topic 2006

Rapid Assessment Methodology for the Detection of Microbiological Indicators

To assess beach water quality, the Department of Environmental Services (DES) monitors fecal indicator bacteria levels at coastal beaches on a routine basis. Unfortunately, results from sample analysis can take anywhere from 24 to 48 hours. Because it takes at least 24 hours to receive results, beach managers and the public are not informed of water quality problems until after the public may have been exposed. This is an issue facing beach officials throughout the world, and is a priority of the US Environmental Protection Agency (EPA). The EPA, universities and private entities are researching rapid assessment methods to enumerate bacteria and viruses. These methods will allow beach officials to post advisories on the same day water quality is impaired, thus, better protecting public health. There are three different rapid assessment method technologies available: Molecular surface recognition, nucleic acid detection and enzyme/substrate based methods. All rapid assessment methods will take less than two hours to obtain results.

Molecular surface recognition methods capture and/or label the target bacterium by binding to molecular structures on the exterior surface or in its genetic material. Analyses of coastal beach water samples currently employ culture-based methods for the detection of Enterococci bacteria, an indicator for fecal pollution in marine water. The quickest culture-based method takes up to 24 hours to provide results. Now, a new method is being developed to enumerate Enterococci. This new method uses Transcription-Mediated Amplification (TMA) with a fluorescently-labeled probe to amplify a specific region of Enterococci ribosomal RNA (rRNA).

The TMA rapid assessment method is currently being tested in Southern California. Method development is moving quickly and will likely come to execution within five years. Method cost is a significant reason the new technology is not currently employed. Once this procedure is widely and routinely accepted, the expenses should lower. This rapid assessment method is very beneficial as it will allow beach managers to take immediate action towards protecting the public from waterborne pathogen exposure on the same day water is sampled.

Another rapid assessment method being developed for fecal indicator is Quantitative Polymerase Chain Reaction (QPCR). QPCR is a nucleic acid detection method that targets genetic material of bacteria, viruses or protozoan indicators. QPCR is used to test for both *E. coli* and Enterococci. Results can be obtained from this method on an average of two hours after sampling. This method has demonstrated 85-90 percent agreement with existing routine methods. QPCR can be used to detect other water quality indicators such as *Bacteroides thetaiotamicron* and human enterovirus. Studies indicate that ratios of *B. thetaiotamicron* may provide useful information as to fecal contamination sources.

The final rapid assessment technology methods available are the enzyme/substrate based methods. These methods pair chromogenic or fluorogenic substrate methods already widely used with advanced optical or electrical detectors. These methods are directed at reducing the incubation periods of current membrane filtration methods. Some of these methods measure excitation and absorbance of the fluorescent metabolite of Enterococci using a fluorometer to speed the detection rate. A popular type of enzyme/substrate method is called Dual-Wavelength Fluorimetry (DWF).

These rapid assessments methods are currently being tested for accuracy, sensitivity and efficiency. Research indicates that these new methods will be made available within the next five years. Once these technologies are made available and laboratories adopt the methods, beach management will have a new tool to better protect public health. With assistance from EPA Beach Grants, New Hampshire be proactive in employing accepted methods.